

## Early Thoracic Duct Ligation for Postoperative Chylothorax

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Four cases of postoperative chylothorax occurring at this institution over the past 5 years, as well as an extensive review of the world literature, are presented. Of the four cases, three occurred after resection of carcinoma of the lung and one after resection of recurrent chondrosarcoma of the chest wall. These patients were treated nonoperatively for varying periods of time ranging from 2 days to nearly 3 weeks. Subsequently, all patients underwent ligation of the thoracic duct. Early reoperation for ligation of the thoracic duct resulted in no morbidity or mortality. In one case of delayed thoracic duct ligation, after an attempt at ligation of minor lymphatic vessels, the single mortality occurred. In view of the experience with these patients and that reported in the literature, we propose that not only is thoracic duct ligation superior to nonoperative management, but that it should be undertaken without delay. © 1996 Wiley-Liss, Inc.

**KEY WORDS:** complications of pulmonary resection, lung cancer, postoperative chylothorax

### INTRODUCTION

Since 1948, when Lampson [1] reported ligation of the thoracic duct for chylothorax, the treatment for this often fatal complication has been controversial. The advent of the use of total parenteral nutrition (TPN) has made it tempting to simply stop all oral intake in an attempt to slow the flow of chyle into the pleural space. This technique, however, can take days to weeks to be effective. It also carries the risks of placement and maintenance of central venous access.

Current therapy is based on decades of evolution. Schackelford and Fisher in 1938 [2], as well as Lampson [1], reported several creative treatments used at that time, including readministration of the chyle via intravenous, sternal, nasogastric, and rectal routes. Intentional pneumothorax and local radiation were also attempted, all with little success and high morbidity and mortality.

Gingell, in 1965 [3], reported the successful use of talc pleurodesis in three cases, two spontaneous and one postoperative. More recently, video-assisted thoracoscopy [4,5] has been introduced as an alternative to thoracotomy for the performance of talc pleurodesis, clipping of the thoracic duct, and/or application of fibrin glue. Pleuroperitoneal shunts have also been employed with thoracoscopic assistance.

The debate continues into the current literature, and is centered on "conservative" therapy (chest tube drainage and TPN) vs. surgical management, most commonly ligation of the thoracic duct above the right hemidiaphragm. Selle et al. in 1973 [6], as well as Marts et al. in 1992 [7], concluded that an initial period of drainage with dietary modification should be attempted. Thoracic duct ligation is recommended if drainage totals more than 1,500 cc/day or continues for more than 2 weeks.

Patients who develop chylothorax after thoracotomy are a unique group in that the chyle leak is more easily diagnosed. The chest drainage tubes placed intraoperatively are closely monitored in the postoperative period, and any increase or change in quality of the drainage is quickly noted. Once the fluid is determined to be a chylous effusion, the patient can immediately be prepared for reoperation.

The following cases are presented in support of early ligation of the thoracic duct in postoperative chylothorax.

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## MATERIALS AND METHODS

Four cases of postoperative chylothorax occurring at our institution from 1990 through 1994 were reviewed. A brief history was obtained from the medical record of each patient, including such information as age, diagnosis, procedure(s), and pathology. Also recorded were data regarding the postoperative chylothorax: the date of its diagnosis, chest tube drainage, method of treatment, and time until resolution of the chylous effusion.

### Case Reports

**Patient 1.** A 75-year-old black male with a past medical history of non-insulin-dependent diabetes mellitus and arthritis was referred for thoracic surgery because of a right upper lobe mass found on chest X-ray during treatment for pneumonia. A biopsy taken during bronchoscopy revealed nonkeratinizing epidermoid cancer. Via a right thoracotomy, upper and middle bilobectomy was performed. The patient's postoperative course was complicated by a continued right-sided effusion. Thoracentesis on postoperative day 17 obtained 1,800 cc of chylous fluid. Several areas of mediastinal lymphatic vessels were ligated through a right thoracotomy on day 19. Despite having nothing by mouth, and being placed on TPN for 2 weeks, the drainage continued. He was taken to the operating room once again, on postoperative day 34, for decortication and ligation of the main thoracic duct above the right diaphragm. Chest tube drainage gradually declined to less than 100 cc per day over the next 2 weeks. The patient deteriorated, however, with the onset of sepsis and renal failure, and he expired 15 days after the thoracic duct ligation.

**Patient 2.** A 30-year-old male had a past medical history significant for splenectomy in 1983 after a car accident, and multiple resections of extensive chest wall chondrosarcoma. He underwent a right thoracotomy at another hospital, and developed chylothorax postoperatively. On postoperative day 15 he was transferred to Beth Israel Medical Center for thoracic duct ligation. The drainage progressively decreased over the next week, and the chest tube was removed 16 days after the duct ligation. His hospital course was complicated by an esophageal-pleural fistula for which he underwent an esophagostomy with esophageal exclusion. However, at this point, the drainage had decreased to less than 100 cc/day, so the fistula was deemed to be a separate entity from the chylous effusion. The patient was discharged home, then readmitted for esophageal replacement, without recurrence of the chylothorax.

**Patient 3.** A 54-year-old Hispanic male with a history of a partial gastrectomy for ulcer and a history of bladder cancer, was found, in addition, to have a left upper lobe lung lesion. A left thoracotomy and left upper lobe wedge resection were performed and a poorly differ-

entiated carcinoma was found. All nodes and margins were negative. Postoperatively, the chest tube output increased dramatically as the patient began taking food, and did not abate with the institution of a clear liquid diet and TPN. Reoperation was delayed due to a postoperative transient ischemic attack. Once stable, the patient returned to the operating room on postoperative day 12 for thoracic duct ligation. Chest tube output decreased rapidly over the next 3 days, and the tubes were all removed by the fifth day following the duct ligation.

**Patient 4.** A 57-year-old woman had a past medical history of no major medical condition, but of significant tobacco and alcohol use. She was found to have right upper lobe carcinoma of the lung, and underwent bronchoscopy and mediastinoscopy with negative results, and without complication. Four days later she had a right upper lobectomy and mediastinal node dissection. Postoperatively she did well, except that the chest tube output began increasing on postoperative day 5, and chylothorax was diagnosed on the next day. On postoperative day 8, she returned to the operating room for thoracic duct ligation. The chest tube drainage subsequently decreased and she was discharged home on the tenth day following the second procedure.

## RESULTS

Of the four cases of chylothorax reported here, three occurred following pulmonary resection with complete mediastinal node dissection for carcinoma. One case developed after multiple resections for extensive chondrosarcoma of the chest wall, including thoracotomy and pleurectomy. The sole mortality occurred in a case in which duct ligation was delayed for over one month with conservative therapy and by an unsuccessful attempt to ligate minor lymphatic vessels at the site of the leak. Two patients were treated nonoperatively for approximately 2 weeks, then taken to the operating room for thoracic duct ligation with subsequent resolution of the chylothorax. The length of hospital stay was over 1 month for patient 2 and 19 days for patient 3. The fourth patient underwent thoracic duct ligation on the second day following diagnosis of chylothorax, with gradual decrease in chest tube drainage over the next week. The total length of hospital stay for the patient was 18 days.

## DISCUSSION

The diagnosis of chylothorax carries with it high morbidity and mortality to this day. Fortunately, it occurs rarely (less than 1% in most series [4,8-10]). Unfortunately, it is this same low incidence that makes the study of treatment modalities difficult. Gathering a large series, even in a multicenter trial, is simply not feasible. It is for this reason that we must rely on the collection of historical data to evaluate changing therapeutic options.

In addition to the clinical cases described above, an

TABLE I. Reported Treatment and Mortality of Postoperative Chylothorax\*

Author (year)	Number of post- operative cases	Procedure (if known)				Period from surgery to diagnosis	Period from diagnosis to ligation	Mortality (by treatment modality)			Reported incidence <sup>a</sup>
		Pulmonary	CV	Esophagus	Other			Non- operative	Duct ligation	Overall (%)	
Lampson (1948) [1]	4	—	—	—	4	Unknown	Unknown	1/3	1/1	50	NC
Brewer (1955) [11]	3	1	—	2	—	Unknown	Unknown	0/1	0/2	0	NC
Goorwitch (1955) [12]	8	1	—	1	6	Unknown	Unknown	0/3	0/5	0	NC
Williams and Burford (1964) [13]	2	—	—	1	1	Unknown	Unknown	1/2	—	50	NC
Fekete et al. (1972) [14]	16	—	—	16	—	3-10 d	11-20 d	5/10	2/6	44	1.49%
Cevese et al. (1975) [15]	5	1	1	2	1	Unknown	Unknown	0/5	—	0	0.2%
Hertzog et al. (1975) [10]	11	11	—	—	—	0-60 d	3-28 d	0/3	— <sup>b</sup>	0	0.15% <sup>c</sup>
Chauvin et al. (1976) [16]	8	2	1	5	—	Unknown	Unknown	2/4	2/4	50	NC
Pilichowski et al. (1976) [17]	2	1	—	1	—	6-10 d	30 d	0/1	— <sup>d</sup>	0	0.13%
Witz et al. (1976) [18]	5	2	1	1	1	4-5 d	12-52 d	0/1	1/2 <sup>e</sup>	33	NC
Rubin et al. (1977) [19]	3	—	—	2	1	4 d-1 mo	Unknown	0/1	0/2	0	NC
Patterson et al. (1981) [20]	5	1	—	3	1	7-29 d	6-29 d	—	1/5	20	NC
Kostiainen et al. (1983) [21]	5	1	2	—	2	Unknown	28 d	0/4	0/1	0	0.69%
Ferguson et al. (1985) [22]	13	2	1	7	3	5-30 d	16-58 d	4/7	0/6	31	0.36%
Milsom et al. (1985) [23]	4	3	1	—	—	0-1 d	4-56 d	1/1	0/2 <sup>f</sup>	33	NC
Riquet et al. (1989) [24]	6	6	—	—	—	Unknown	Unknown	0/3	— <sup>g</sup>	0	NC
Marts et al. (1992) [7]	6	1	—	5	—	Unknown	Unknown	1/1	1/5	33	NC
Sarsam et al. (1994) [8]	9	9	—	—	—	5-6 d	~7-21 d	0/5	0/4	0	0.5%
Terzi et al. (1994) [9]	13	13	—	—	—	2-15 d	2-17 d	0/5	0/8	0	0.74%
Beth Israel	4	3	—	—	1	2-17 d	2-30 d	—	1/4	25	0.8%
Totals	132	58	7	46	21			15/60	9/57	21	

\*NC, not calculated; CV, cardiovascular.

<sup>a</sup>Reported incidence for entire series; will include pediatric, traumatic, and spontaneous cases in some series.<sup>b</sup>Eight cases treated with ligation of minor lymphatic channels. Two reoperations.<sup>c</sup>Calculated for last 10 years of the series.<sup>d</sup>One case treated with rib resection.<sup>e</sup>As well as two cases with thoracic exploration.<sup>f</sup>As well as one case treated with pleuroperitoneal shunt.<sup>g</sup>Three cases treated with ligation of minor lymphatics.

extensive search of the English and French-language literature was undertaken. Articles were obtained using a Medline computer search, then papers prior to 1966 (the limit of the Medline database) were selected from bibliographies of the earlier papers. Chylothoraces following intrathoracic as well as chest wall procedures in patients

above the age of 12 were included. Not included were single case reports, spontaneous, malignant, or traumatic chylothoraces, and cervical or intra-abdominal causes of chylothorax. The type of procedure, the time from surgery to diagnosis, and from diagnosis until surgical intervention (if known) were recorded. Also tabulated were the

number of patients undergoing conservative and surgical treatment, the mortality associated with each, and the overall incidence in each series (if reported). These data are summarized in Table I.

In 19 journal articles spanning nearly 50 years, 128 adult cases of postoperative chylothorax were reported [1,7–24]. Four cases (reported above) from this institution were added to the series. The majority of these were either pulmonary ( $58/132 = 44\%$ ) or esophageal ( $46/132 = 35\%$ ). A small percentage were cardiovascular ( $7/132 = 5\%$ ). Other cases (16%) included thoracic sympathectomy, mediastinoscopy and mediastinal tumor resection, thoracic aortic aneurysm resection, and our case of resection of chest wall tumor that extended to the mediastinum. The period from surgery to diagnosis of chylothorax varied widely, but most seemed to occur within the first week, with some as long as 1 month later. Similarly, the time period from the diagnosis to thoracic duct ligation varied from later the same day to nearly 2 months. In 11 of the 19 papers, one or both of these times were not recorded.

Nearly equal numbers of patients in this series underwent duct ligation (45%) and nonoperative therapy (43%). The remaining 11 patients were treated operatively with ligation of minor lymphatics, pleuroperitoneal shunt, thoracoplasty, or exploratory thoracotomy (not otherwise specified). The combined mortality for the group treated nonoperatively was 25%, compared to a 16% mortality for those undergoing thoracic duct ligation. The overall mortality for the series is 21%. The incidence, from those papers where it was calculated, is listed in the last column of Table I. These numbers, however, are not adjusted for postoperative adult cases, and thus will include spontaneous, traumatic, and pediatric chylothoraces.

Over the past 50 years, the mortality of chylothorax has decreased only slightly. Often reported as nearly 50% in the 1950s [1,12,25], mortality in the past decade is closer to 30% [7,22,23]. Including a number of studies with no reported deaths, the overall mortality in this series is 21%. While this represents an improvement, this number of deaths is unacceptable for a potentially curable entity.

Prior to considering treatment options, we must first address the cause of the chyle leak and any possible means of avoiding injury to the lymphatic system. Careful study of the anatomy of the thoracic duct, as well as lymphatic anomalies [26], can allow the surgeon to avoid the main thoracic duct as it courses through the chest. However, cadaver studies by Riquet et al. [24] demonstrate many collaterals, including drainage of lymph directly from the lung into the thoracic duct, as well as vessels from the lower lobes traveling to the duct via the pulmonary ligament. Thus, careful ligation of all structures that are divided (regardless of potential for bleeding) should minimize the risk of a significant chyle leak.

Postoperatively, the chest tube output should be carefully monitored as the patient begins oral intake. Diet can be resumed as early as postoperative day 1 in patients not undergoing esophageal procedures. These patients will frequently have jejunostomy tubes, and feeding should commence as soon as the intestinal function will allow. Any increase in output, or change in character of the drained fluid, must be regarded with a high index of suspicion for chylothorax, despite the rarity of the condition, as early diagnosis is crucial.

## CONCLUSIONS

Since Lampson reported the successful ligation of the thoracic duct in the chest in 1948 [1], this technique has gained support in the treatment of refractory chylothorax. While preparing for reoperation, some form of diet restriction (NPO, clear liquid, low fat or medium chain triglyceride diet [27]) is combined with dietary supplementation (usually TPN). Although often termed “conservative” treatment, delaying reoperation for 2 weeks or more (as previously suggested) increases the risk of poor nutritional status, with the inherent risk of immunocompromise, and exposes the patient to the complications of central venous access (pneumothorax, hemothorax, catheter infection, especially fungal sepsis, and vein thrombosis). Because the chylous effusion can often be diagnosed in the early postoperative period, it is our opinion that patients will better tolerate reoperation immediately after the diagnosis is made, and before any of the above complications can take place. We recommend early reoperation to include not only a search for chylous leaks in the operative field, but also thoracic duct ligation. It remains to be seen whether this aggressive approach, possibly combined with video-assisted thoracoscopic techniques, will be successful in further decreasing the morbidity and mortality of postoperative chylothorax.

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